

Appl. No. 10/665,028

Amdt. Dated May 1, 2006

Reply to Final Office Action of January 31, 2006

AMENDMENTS TO THE CLAIMS

Claim 1 (currently amended) A laser nozzle for laser powder fusion welding, comprising:

a main body;

an inner tip coupled to the main body;

an outer nozzle coupled to the main body and circumscribing the inner tip and spaced apart there from to define a powder flow channel there between, the outer nozzle having a first end proximal to the main body and a second end distal to the main body;
and

a housing detachably coupled to the ~~main body~~ outer nozzle and circumscribing the second end of the outer nozzle in spaced apart relationship to define a circumscribing shield gas flow channel about the outer nozzle, the shield gas flow channel having an opening adjacent to the second end of the outer nozzle.

Claim 2 (previously presented) A laser nozzle for laser powder fusion welding as set forth in Claim 1, wherein:

the main body defines a central passage through which light may travel, the main body defines a powder flow conduit in communication with the powder flow channel, and the main body defines a coolant channel coaxial with the central passage.

Claim 3 (original) A laser nozzle for laser powder fusion welding as set forth in Claim 2, further comprising:

a water jacket cover coupled to the main body and enclosing the coolant channel to prevent coolant leakage, the water jacket cover defining a powder tube depression through which a powder tube may pass and communicate with the powder flow conduit.

Claim 4 (original) A laser nozzle for laser powder fusion welding as set forth in Claim 2, further comprising:

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a porous shielding cover coupled to and circumscribing the outer nozzle, the porous shielding cover allowing gas to exit from the shield gas flow channel and preventing entry of material into the shield gas flow channel, the porous shielding cover circumscribed by and coupled to the housing.

Claim 5 (currently amended) A laser nozzle for laser powder fusion welding, comprising:

a detachable inner tip;

a detachable outer nozzle circumscribing the inner tip in spaced apart relationship to define a circumscribing powder flow channel about the inner tip, the outer nozzle having a first end with a first width and a second end with a second width, the first width being greater than the second width;

a detachable housing circumscribing the second end of the outer nozzle in spaced apart relationship to define a circumscribing shield gas flow channel about the outer nozzle, the shield gas flow channel having an opening adjacent to the second end of the outer nozzle;

a main body coupling the inner tip, the outer nozzle and the housing, the main body defining a central passage through which light may travel, the main body defining a powder flow conduit in communication with the powder flow channel, the main body defining a coolant channel coaxial with the central passage;

a detachable water jacket cover coupled to the main body and enclosing the coolant channel to prevent coolant leakage, the water jacket cover defining a powder tube depression through which a powder tube may pass and communicate with the powder flow conduit; and

a detachable porous shielding cover coupled to and circumscribing the outer nozzle, the porous shielding cover allowing gas to exit from the shield gas flow channel and preventing entry of material into the shield gas flow channel, the porous shielding cover circumscribed by and coupled to the housing.

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Claim 6 (currently amended) A coaxial nozzle for laser powder fusion (LPF) welding, comprising:

a main body defining a central light passage through which light may pass through the main body, the main body defining a powder conduit through which powder may pass through the main body, the main body defining a coolant channel through which coolant may flow, the coolant channel coaxial with the central light passage and circumscribing the powder conduit;

a coolant jacket cover detachably attached to the main body and sealing the coolant channel, the coolant jacket defining an inlet and an outlet to the coolant channel;

an inner tip defining a first central open channel through which light may pass, the inner tip detachably attached to a terminal end of the main body, the inner tip coaxial with the central light passage of the main body;

an outer nozzle defining a second central open channel through which powder may pass, the outer nozzle detachably attached to the main body and having a first end with a first width and a second end with a second width, the first width being greater than the second width, the outer nozzle coaxial with the first central open channel of the inner tip and the central light passage of the main body, a powder flow channel defined between the outer nozzle and the inner tip in communication with the powder conduit;

a housing defining a third central open channel through which fluid may pass, the housing detachably attached to the main body and circumscribing the second end of the outer nozzle, the housing coaxial with the second central open channel and the first central open channel and the central light passage, a shield gas flow channel defined between the outer nozzle and the housing and having an opening adjacent to the second end of the outer nozzle; and

a detachable porous shielding cover circumscribing a terminal end of the outer nozzle and covering an open end of the shield gas flow channel.

Claim 7 (currently amended) A nozzle for laser powder fusion welding, comprising:

a detachable tip having a first central light passage;

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the nozzle defining a second central light passage aligned and communicating with the first central light passage;

the nozzle defining a powder flow passage circumscribing and coaxial with the central light passage;

the nozzle defining a shield gas flow passage circumscribing and coaxial with the powder flow passage and the central light passage;

an outer nozzle detachably attached to the nozzle, the outer nozzle separating the powder flow passage from the shield gas flow passage, the outer nozzle having a first end with a first width and a second end with a second width, the first width being greater than the second width;

a housing detachably attached to the nozzle and circumscribing the second end of the outer nozzle in spaced apart relationship to define the shield gas flow passage, the shield gas flow passage having an opening adjacent to the second end of the outer nozzle and proximate the tip; and

a detachable porous shielding cover covering; and

~~an open end of the shield gas flow passage proximate the tip.~~

Claim 8 (original) A nozzle for laser powder fusion welding as set forth in Claim 7, further comprising:

a main body defining the second central light passage;

the main body defining a powder conduit in communication with the powder flow passage;

the main body defining a coolant channel at a top end thereof; and

a coolant jacket cover detachably attached to the top of the main body and sealing the coolant channel, the coolant jacket defining a coolant inlet and a coolant outlet.

Claim 9 (currently amended) A nozzle for laser powder fusion welding as set for the forth in Claim 7, wherein:

the outer nozzle directs powder flow to a focus point in front of the first central light passage.